What is claimed is:

1. A screen for use with image-forming illumination which has a longest image-forming wavelength λ_{long}, said screen comprising:
   (a) a substrate having first and second opposing surfaces and a target thickness τ;
   (b) an array of lenses associated with the first surface;
   (c) a layer of light-absorbing material associated with the second surface, said layer of light-absorbing material comprising a plurality of apertures formed by a process which comprises passing aperture-forming illumination through the array of lenses, said layer having an overall area and an area that is light blocking;

   wherein τ has a value such that:
   (i) the apertures do not substantially block light at λ_{long}; and
   (ii) the ratio ρ of the area that is light blocking to the overall area exceeds 0.5.

2. The screen of Claim 1 wherein the array of lenses is an array of randomized lenses.

3. The screen of Claim 1 wherein the array of lenses is an array of microlenses.

4. The screen of Claim 3 wherein the array of lenses is an array of randomized microlenses.

5. The screen of Claim 1 wherein the array of lenses is an array of anamorphic microlenses.

6. The screen of Claim 5 wherein the array of lenses is an array of randomized anamorphic microlenses.

7. The screen of Claim 5 or 6 wherein: (i) for the aperture-forming illumination, the array of anamorphic microlenses defines an aperture-forming focal plane; and (ii) τ has a value such that the layer of light-absorbing material substantially lies at said focal plane.

8. The screen of Claim 7 wherein the anamorphic microlenses have fast axes and slow axes and the aperture-forming focal plane corresponds to the fast axes.

9. The screen of Claim 7 wherein the anamorphic microlenses have fast axes and slow axes and the aperture-forming focal plane corresponds to the slow axes.

10. The screen of Claim 5 or 6 wherein the anamorphic microlenses have fast axes and slow axes and unequal diameters along said fast and slow axes.

11. The screen of Claim 10 wherein D_f is a fast axis diameter and D_s is a slow axis diameter and $D_f > D_s$.

12. The screen of Claim 1 or 2 wherein: (i) the lenses are characterized by a thin-lens paraxial focal length f_{exp} associated with the aperture-forming illumination and a thin-lens paraxial focal length f_{max} associated with λ_{long}; and (ii) τ substantially satisfies the relationship:

$$\frac{2}{\tau} = \frac{1}{f_{exp}} + \frac{1}{f_{max}}.$$

13. The screen of Claim 1 or 2 wherein: (i) the lenses are characterized by a thin-lens paraxial focal length f_{exp} associated with the aperture-forming illumination and a thin-lens paraxial focal length f_{max} associated with λ_{long}; and (ii) τ substantially satisfies the relationship:

$$\frac{2}{\tau} = \frac{1}{f_{exp} + \Delta f_{exp}} + \frac{1}{f_{max} + \Delta f_{max}},$$

where Δf_{exp} and Δf_{max} are respectively variations in f_{exp} and f_{max} due to the lenses having finite thicknesses.

14. The screen of Claim 1 or 2 wherein: (i) the lenses are characterized by a thin-lens paraxial focal length f_{exp} associated with the aperture-forming illumination and a thin-lens paraxial focal length f_{max} associated with λ_{long}; and (ii) τ substantially satisfies the relationship:

$$2\frac{f_{exp} f_{max}}{f_{exp} + f_{max}} \le \tau < f_{exp}\left(1 + \frac{1}{\sqrt{2}}\right).$$

15. The screen of Claim 14 wherein ρ substantially satisfies the relationship:

$$\frac{1}{2} < \rho \le \frac{4 f_{exp} f_{max}}{\left(f_{exp} + f_{max}\right)^2}.$$

16. The screen of Claim 3, 4, 5, or 6 wherein: (i) the microlenses are characterized by a thin-lens paraxial focal length f_{exp} associated with the aperture-forming illumination and a thin-lens paraxial focal length f_{max} associated with λ_{long}; and (ii) τ substantially satisfies the relationship:

$$\frac{2}{\tau} = \frac{1}{f_{exp}} + \frac{1}{f_{max}}.$$

17. The screen of Claim 3, 4, 5, or 6 wherein: (i) the microlenses are characterized by a thin-lens paraxial focal length f_{exp} associated with the aperture-forming illumination and a thin-lens paraxial focal length f_{max} associated with λ_{long}; and (ii) τ substantially satisfies the relationship:

$$\frac{2}{\tau} = \frac{1}{f_{exp} + \Delta f_{exp}} + \frac{1}{f_{max} + \Delta f_{max}},$$

where Δf_{exp} and Δf_{max} are respectively variations in f_{exp} and f_{max} due to the microlenses having finite thicknesses.

18. The screen of Claim 3, 4, 5, or 6 wherein: (i) the microlenses are characterized by a thin-lens paraxial focal length f_{exp} associated with the aperture-forming illumination and a thin-lens paraxial focal length f_{max} associated with λ_{long}; and (ii) τ substantially satisfies the relationship:

$$2\frac{f_{exp} f_{max}}{f_{exp} + f_{max}} \leq \tau < f_{exp}\left(1 + \frac{1}{\sqrt{2}}\right).$$

19. The screen of Claim 18 wherein ρ substantially satisfies the relationship:

$$\frac{1}{2} < \rho \leq \frac{4 f_{exp} f_{max}}{\left(f_{exp} + f_{max}\right)^2}.$$

20. The screen of Claim 1 wherein in at least one direction (the x-direction), the lenses have a sag s(x) which substantially satisfies the relationship:

$$s(x) = \frac{x^2}{2R_{eq}} + \sum_{k=2}^{\infty} c_{2k} x^{2k},$$

where R_{eq} is an equivalent radius of curvature and the c_{2k}'s are coefficients of higher-order terms.

21. The screen of Claim 20 wherein R_{eq} and τ substantially satisfy a relationship of the form:

$$R_{eq} = \left(1 - \frac{1}{2n_{exp}} - \frac{1}{2n_{max}}\right)\tau,$$

where n_{exp} and n_{max} are indices of refraction of the lenses associated with the aperture-forming illumination and with λ_{long}, respectively.

22. The screen of Claim 1 wherein in at least one direction (the x-direction), the lenses have a sag s(x) which substantially satisfies the relationship:

$$s(x) = \alpha\left(R_s - \sqrt{R_s^2 - x^2}\right) + \frac{x^2}{2R_p},$$

where R_s is a spherical radius of curvature, R_p is a parabolic radius of curvature, and α is a scale factor.

23. The screen of Claim 22 wherein at least one of R_s, R_p, and α is randomized.

24. The screen of Claim 23 wherein at least one of R_s, R_p, and α is not randomized and is selected to substantially satisfy a relationship of the form:

$$\frac{R_p R_s}{\alpha R_p + R_s} = \left(1 - \frac{1}{2n_{\exp}} - \frac{1}{2n_{\max}}\right)\tau,$$

where n_{exp} and n_{max} are indices of refraction of the lenses associated with the aperture-forming illumination and with λ_{long}, respectively.

25. The screen of Claim 1 wherein the lenses have a sag s(x,y) which substantially satisfies the relationship:

$$s(x,y) = \frac{\alpha_x x^2/R_{sx} + \alpha_y y^2/R_{sy}}{1 + \sqrt{1 - x^2/R_{sx}^2 - y^2/R_{sy}^2}} + \frac{x^2}{2R_{px}} + \frac{y^2}{2R_{py}},$$

where R_{sx} and R_{sy} are spherical radii of curvature, R_{px} and R_{py} are parabolic radii of curvature, and α_x and α_y are scale factors.

26. The screen of Claim 25 wherein at least one of R_{sx}, R_{sy}, R_{px}, R_{py}, α_x, and α_y is randomized.

27. The screen of Claim 1 wherein the lenses have a sag s(x,y) which substantially satisfies the relationship:

$$s(x,y) = \alpha_x\left(R_{sx} - \sqrt{R_{sx}^2 - x^2}\right) + \frac{x^2}{2R_{px}} + \alpha_y\left(R_{sy} - \sqrt{R_{sy}^2 - y^2}\right) + \frac{y^2}{2R_{px}},$$

where R_{sx} and R_{sy} are spherical radii of curvature, R_{px} and R_{py} are parabolic radii of curvature, and α_x and α_y are scale factors.

28. The screen of Claim 27 wherein at least one of R_{sx}, R_{sy}, R_{px}, R_{py}, α_x, and α_y is randomized.

29. The screen of Claim 3, 4, 5, or 6 wherein the array is selected from the group consisting of a close-packed square array, a close-packed rectangular array, a close-packed hexagonal array, a close-packed hexagonal array with microlens

units having spherical boundaries, and a random spatial arrangement with microlens units having polygonal boundaries.

30. The screen of Claim 3, 4, 5, or 6 wherein the shape of the apertures is selected from the group consisting of horizontally-modulated lines, vertically modulated lines, horizontal ovals, horizontal ovals in a hexagonal spatial arrangement, horizontal ovals in a square spatial arrangement, vertical ovals, vertical ovals in a hexagonal spatial arrangement, vertical ovals in a square spatial arrangement, horizontal ovals of varying sizes, horizontal ovals of varying sizes in a randomized spatial arrangement, vertical ovals of varying sizes, and vertical ovals of varying sizes in a randomized spatial arrangement.

31. The screen of Claim 1 wherein ρ is at least 0.7.

32. The screen of Claim 1 wherein the screen has a transmission efficiency which is greater than 80%.

33. The screen of Claim 1 wherein a space exists between at least two of the lenses that is randomly interpolated.

34. The screen of Claim 1 wherein the array of lenses is an array of microlenses and wherein the microlenses have different diameters along two perpendicular directions.

35. The screen of Claim 1 wherein λ_{long} is approximately 700 nm.

36. The screen of Claim 1 wherein the array of lenses and the substrate constitute separate components.

37. The screen of Claim 1 wherein the array of lenses and the substrate constitute a single unitary component.

38. A screen comprising a layer of light-absorbing material which comprises a plurality of apertures, said apertures having a shape selected from the group consisting of horizontally-modulated lines, vertically modulated lines, horizontal ovals, horizontal ovals in a hexagonal spatial arrangement, horizontal ovals in a square spatial arrangement, vertical ovals, vertical ovals in a hexagonal spatial arrangement, vertical ovals in a square spatial arrangement, horizontal ovals of varying sizes, horizontal ovals of varying sizes in a randomized spatial arrangement, vertical ovals of varying sizes, and vertical ovals of varying sizes in a randomized spatial arrangement.

39. A screen comprising a substrate and an array of lenses associated with the substrate wherein a space exists between at least two of the lenses that is randomly interpolated.

40. A method for producing a screen for use with image-forming illumination, said method comprising:

    (a) providing a substrate having first and second opposing surfaces;

    (b) associating an array of anamorphic microlenses with the first surface;

    (c) associating a layer of a light-absorbing material with the second surface; and

    (d) forming a plurality of apertures in the layer of light-absorbing material by passing aperture-forming illumination through the array of microlenses;

    wherein the optical properties of the microlenses and a target thickness for the substrate are selected so as to maximize the light-blocking area of the layer of light-absorbing material while allowing image-forming illumination to pass through the layer's apertures substantially unimpeded.

41. The method of Claim 40 wherein the array of anamorphic microlenses is an array of randomized anamorphic microlenses.

42. The method of Claim 40 or 41 wherein the anamorphic microlenses have fast axes and slow axes.

43. The method of Claim 42 wherein in step (d), the fast axes are used to form the apertures.

44. The method of Claim 42 wherein in step (d), the slow axes are used to form the apertures.

45. The method of Claim 42 wherein the anamorphic microlenses have unequal diameters along said fast and slow axes.

46. The method of Claim 45 wherein D_f is a fast axis diameter and D_s is a slow axis diameter and $D_f > D_s$.

47. A method for producing a screen for use with image-forming illumination which has a longest image-forming wavelength λ_{long}, said method comprising:

    (a) providing a substrate having first and second opposing surfaces;

    (b) associating an array of lenses with the first surface;

(c) associating a layer of a light-absorbing material with the second surface; and

(d) forming a plurality of apertures in the layer of light-absorbing material by passing aperture-forming illumination through the array of lenses;

wherein (i) the lenses are characterized by a thin-lens paraxial focal length f_{exp} associated with the aperture-forming illumination and a thin-lens paraxial focal length f_{max} associated with λ_{long}; and (ii) the substrate has a target thickness τ which is selected using the relationship:

$$\frac{2}{\tau}=\frac{1}{f_{\exp}}+\frac{1}{f_{\max}}.$$

48. A method for producing a screen for use with image-forming illumination which has a longest image-forming wavelength λ_{long}, said method comprising:

(a) providing a substrate having first and second opposing surfaces;

(b) associating an array of lenses with the first surface;

(c) associating a layer of a light-absorbing material with the second surface; and

(d) forming a plurality of apertures in the layer of light-absorbing material by passing aperture-forming illumination through the array of lenses;

wherein (i) the lenses are characterized by a thin-lens paraxial focal length f_{exp} associated with the aperture-forming illumination and a thin-lens paraxial focal length f_{max} associated with λ_{long}; and (ii) the substrate has a target thickness τ which is selected using the relationship:

$$\frac{2}{\tau}=\frac{1}{f_{\exp}+\Delta f_{\exp}}+\frac{1}{f_{\max}+\Delta f_{\max}},$$

where Δf_{exp} and Δf_{max} are respectively variations in f_{exp} and f_{max} due to the lenses having finite thicknesses.

49. A method for producing a screen for use with image-forming illumination which has a longest image-forming wavelength λ_{long}, said method comprising:

(a) providing a substrate having first and second opposing surfaces;

(b) associating an array of lenses with the first surface;

(c) associating a layer of a light-absorbing material with the second surface; and

(d) forming a plurality of apertures in the layer of light-absorbing material by passing aperture-forming illumination through the array of lenses;

wherein:

(i) in at least one direction (the x-direction), the lenses have a sag s(x) which substantially satisfies the relationship:

$$s(x) = \frac{x^2}{2R_{eq}} + \sum_{k=2}^{\infty} c_{2k} x^{2k},$$

where R_{eq} is an equivalent radius of curvature and the c_{2k}'s are coefficients of higher-order terms; and

(ii) the substrate has a target thickness τ which is selected using the relationship:

$$R_{eq} = \left(1 - \frac{1}{2n_{\exp}} - \frac{1}{2n_{\max}}\right)\tau,$$

where n_{exp} and n_{max} are indices of refraction of the lenses associated with the aperture-forming illumination and with λ_{long}, respectively.

50. A method for producing a screen comprising:

(a) providing a substrate having first and second opposing surfaces;

(b) associating an array of lenses with the first surface;

(c) associating a layer of a light-absorbing material with the second surface; and

(d) forming a plurality of apertures in the layer of light-absorbing material by passing aperture-forming illumination through the array of lenses;

wherein:

(i) in at least one direction (the x-direction), the lenses have a sag s(x) which substantially satisfies the relationship:

$$s(x) = \alpha\left(R_s - \sqrt{R_s^2 - x^2}\right) + \frac{x^2}{2R_p},$$

where R_s is a spherical radius of curvature, R_p is a parabolic radius of curvature, and α is a scale factor; and

(ii) at least one of R_s, R_p, and α is randomized.

51. The method of Claim 50 wherein:

(i) the screen is for use with image-forming illumination which has a longest image-forming wavelength λ_{long}; and

(ii) at least one of R_s, R_p, and α is not randomized and is selected using a relationship of the form:

$$\frac{R_p R_s}{\alpha R_p + R_s} = \left(1 - \frac{1}{2n_{exp}} - \frac{1}{2n_{max}}\right)\tau ,$$

where τ is a target thickness of the substrate and n_{exp} and n_{max} are indices of refraction of the lenses associated with the aperture-forming illumination and with λ_{long}, respectively.

52. A method for producing a screen comprising:

(a) providing a substrate having first and second opposing surfaces;

(b) associating an array of lenses with the first surface;

(c) associating a layer of a light-absorbing material with the second surface; and

(d) forming a plurality of apertures in the layer of light-absorbing material by passing aperture-forming illumination through the array of lenses;

wherein:

(i) the lenses have a sag s(x,y) which substantially satisfies the relationship:

$$s(x,y) = \frac{\alpha_x x^2/R_{sx} + \alpha_y y^2/R_{sy}}{1+\sqrt{1 - x^2/R_{sx}^2 - y^2/R_{sy}^2}} + \frac{x^2}{2R_{px}} + \frac{y^2}{2R_{py}},$$

where R_{sx} and R_{sy} are spherical radii of curvature, R_{px} and R_{py} are parabolic radii of curvature, and α_x and α_y are scale factors; and

(ii) at least one of R_{sx}, R_{sy}, R_{px}, R_{py}, α_x, and α_y is randomized.

53. A method for producing a screen comprising:

(a) providing a substrate having first and second opposing surfaces;

(b) associating an array of lenses with the first surface;

(c) associating a layer of a light-absorbing material with the second surface; and

(d) forming a plurality of apertures in the layer of light-absorbing material by passing aperture-forming illumination through the array of lenses;

wherein:

(i) the lenses have a sag s(x,y) which substantially satisfies the relationship:

$$s(x,y)=\alpha_x\left(R_{sx}-\sqrt{R_{sx}^2-x^2}\right)+\frac{x^2}{2R_{px}}+\alpha_y\left(R_{sy}-\sqrt{R_{sy}^2-y^2}\right)+\frac{y^2}{2R_{px}},$$

where R_{sx} and R_{sy} are spherical radii of curvature, R_{px} and R_{py} are parabolic radii of curvature, and α_x and α_y are scale factors; and

(ii) at least one of R_{sx}, R_{sy}, R_{px}, R_{py}, α_x, and α_y is randomized.